

ARCS PROCEDURE:	MWR FIELD TIPPING CURVE CALIBRATION (CALF)	PRO(MWR)-005.008 13 September 2001 Page 1 of 11
Author: B. Porch		

MWR Field Tipping Curve Calibration (CALF)

I. Purpose:

The purpose of this procedure is to describe the steps performed by the RESET team to acquire the data needed to field calibrate the MWR at an ARCS site. Since the MWR now performs its calibration automatically, this procedure is for RESET to provide on site, current information for quality analysis.

II. Cautions and Hazards:

Note that the new version of the MWR.EXE program has a slightly different display. It will no longer indicate which channel (23 or 31 GHz) or angle it is sampling.

III. Requirements:

- Digital level.
- BBSS data (in development)

IV. Procedure

A. Steps:

1. Go to the MWR with the digital level.
2. Place the level on the underside of the MWR mount and log the level.
3. Read and enter the offset from the MWR computer in calibration form FM(MWR)-003.
4. If the level is more than 1 degree from level, inform the mentor of the amount off level and the offset and follow releveling instructions.
5. Note the time and date on the calibration form.
6. Open a window on the computer that controls the MWR as follows:
 - Bring up a menu (the "window list") by holding down the ALT key and pressing ESC.
 - Use Windows Explorer to find data directory and OPEN ***send_dir***.
 - First unclick; always OPEN with button.

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- Then OPEN files with notepad to view calibration data.
 - The order of the data in the first line is date, file number, noise diode temperature @ 23 GHz, noise diode injection temperature @ 31 GHz, the nominal temperature (tnom), and the temperature changes @ 23 and 31 GHz (tc23 and tc 31, respectively)
7. Log several noise diode temperatures in the calibration record for the MWR.
 8. Also download the offset.log, Ad-calib.log files, and the current configuration file (see B below).
 9. At least once during the RESET visit log the integrated precipitable water vapor (cm) from the MWR during the launch of a BBSS balloon (note: this part of the procedure is still in the development stage).
 10. Calculate the integrated precipitable water from the BBSS using the integrated water vapor code and the BBSS a1 data and compare to the MWR.
 11. Send the configuration file, calibration record, the calibration log, and offset.log file to TWPO <ftp://twppo.lanl.gov> logging in as RESET and using the double nickel password.

B. To Obtain a Current Configuration File and offset log for the MWR

1. Go to the D:mentor directory.
2. In the instrument file download MWR.cfg, offset.log and Ad-calib.log

V. References:

1. Decker, M. T. and J. A. Schroeder, 1991: "Calibration of Ground-Pased Microwave Radiometers for Atmospheric Remote Sensing," NOAA Tech. Memo. ERL WPL-197, Boulder, CO,16 p.
2. Han, Y, J. [3. Snider, E. R. Westwater, S. H. Melfi and R. A. Ferrare,1994: "Observations of Water Vapor by Ground-Based Microwave Radiometers and Raman Lidar," J. Geophys, Res., 99(D9), pp.18,695-18,702.

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3. Jordan, J. and M. Decker, 1990: "Calibration Transfer Target for a Microwave Radiometric Profiling System," NOAA Tech. Memo. ERL WPL-1 89, Boulder, CO, 14p.
4. Liljegren J., 1994a: "Microwave Radiometer Installation, Operations and Maintenance Guide (Version 2.1)," PNL Rept., Richland, WA, 17 Nov.1994, 60 p.
5. Radiometrics Corporation, 1992: "Water Vapor Radiometer," Instrument Manual, May 1992.

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VI. Attachments:

1. FM(MWR)-003: Calibration Form
2. Example of Completed Form
3. Example of MWR Configuration File

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Attachment 1 - FM(MWR)-003: Calibration Form**ARCS MWR Tipping Curve Field Calibration Form****I. Calibration information**

This is a (check which):	<input type="checkbox"/> Calibration	<input type="checkbox"/> Calibration Check	<input checked="" type="checkbox"/> Field Calibration		
			X		
	GMT Begin Date:	GMT Begin Time:	GMT End Date:	GMT End Time:	ARCS #
	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	Instrument / System:	TWP OMS Part Number(s):	TWP OMS Serial Number(s):		
	<input type="text"/> MWR	<input type="text"/> WVR-1100	<input type="text"/>		
Location (eg. PNNL,	Participant(s):	Issued by:	Signature(s):		
<input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/>		

II. Initial Values

offset	<input type="text"/>	Level in Degrees	<input type="text"/>				
Integrated water vapor comparison:	MWR precipitable water vapor (cm)	BBSS Integrated precipitable water vapor (cm)					
Date and Time (GMT)	<input type="text"/>	<input type="text"/>	<input type="text"/>				
Sensor/Element: <input type="text"/> MWR values	Date <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	File number <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	Noise Diode Injection Temp. 23 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	Noise Diode Injection Temp. 31 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	t _{nom} <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	t _{c23} <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	t _{c31} <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>

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III. Final Values

Integrated water vapor comparison:		MWR precipitable water vapor (cm)	BSS Integrated precipitable water vapor (cm)				
Date and Time (GMT)							
Sensor/Element:	Date	File number	Noise Diode Injection Temp. 23	Noise Diode Injection Temp. 31	tnom	tc23	tc31
MWR values							

IV. Calibration Change

Sensor/Element: Change in MWR values	Date	File number	Noise Diode	Noise Diode

Document(s) Referenced:

PRO(MWR)-005.002

Document(s) Updated:

PRO(MWR)-005.007

PROBLEMS:

PROBLEMS:

NOTES:

NOTES:

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Attachment 2 Example of Completed Form

ARCS MWR Tipping Curve Field Calibration Form

I. Calibration information

This is a (check which):	Calibration	Calibration Check	Field Calibration	
			X	
	GMT Begin Date:	GMT Begin Time:	GMT End Date:	GMT End Time:
	6/28/00	0:00	7/6/00	0:00
				ARCS #
				2
Instrument / System:	TWP OMS Part Number(s):	TWP OMS Serial Number(s):		
MWR	WVR-1100	15		
Location (eg. PNNL,	Participant(s):	Issued by:	Signature(s):	
Nauru	Porch			

II. Initial Values

offset	-1	Level in Degrees	.3 to .9				
Integrated water vapor comparison:	MWR precipitable water vapor (cm)	BBSS Integrated precipitable water vapor (cm)					
Date and Time (GMT)	7/06/00 00:00						
Sensor/Element: MWR values	Date 7/2/00 8:00 7/4/00 12:00 7/5/00 00:00 7/5/00 12:00	File number	Noise Diode Injection Temp. 23 236.360 236.835 236.830 236.786	Noise Diode Injection Temp. 31 245.370 245.612 245.600 245.523	t _{nom} 290.0 290.0 290.0 290.0	t _{c23} 0.250 0.000 0.000 0.000	t _{c31} 0.009 0.000 0.000 0.000

III. Final Values

Integrated water vapor comparison:		
Date and Time (GMT)	MWR precipitable water vapor (cm)	BBSS Integrated precipitable water vapor (cm)
7/4/00	4.8	5.006
7/5/00	4.9	5.324
7/5/00	4.5 to 4.6	4.885

Sensor/Element: MWR values	Date	File number	Noise Diode Injection Temp. 23	Noise Diode Injection Temp. 31	t _{nom}	t _{c23}	t _{c31}

IV. Calibration Change

Sensor/Element: Change in MWR values	Date	File number	Noise Diode	Noise Diode

Document(s) Referenced:

PRO(MWR)-005.002

Document(s) Updated:

PROBLEMS:**NOTES:**

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Attachment 3
Example of MWR Configuration File

ARM Microwave Radiometer Configuration File

RADIOMETER IDENTIFICATION (Line 1 in data file)

015 Serial number (3 digits; 000=simulated instrument)

COMPUTER CONFIGURATION

1 COMM port of computer
'E:\SEND_DIR' Directory where data files are placed for collection
60 Create a new data file every N minutes
1 1 = graphical display, 0 = textual display

CALIBRATION (Line 2 in data file)

99 07 21 Date of latest calibration update
1 automatic calibration switch (1=enabled, 0=disabled)
14 maximum number of days between calibration checks
50 minimum number of new tips needed to check calibration
1500 minimum number of tips needed for regression of Tnd on Tbb
3.0 factor for calibration change test limits
0.008 minimum LWP std dev (mm) for clear sky detection
238.13 23.8 GHz noise injection temperature @ T_nominal
245.60 31.4 GHz noise injection temperature @ T_nominal
290.0 T_nominal (K)
-0.013 23.8 GHz temperature correction coefficient (K/K)
-0.011 31.4 GHz temperature correction coefficient (K/K)
0.00164 23.8 GHz window correction coefficient
0.00217 31.4 GHz window correction coefficient

TIP CONFIGURATION (Line 3 in data file)

1000 sky sampling time (milliseconds)
1000 blackbody sampling time (milliseconds)
1000 blackbody+noise diode sampling time (milliseconds)
10 number of elevation angles
19.5 first elevation angle in TIP
23.6
30.0
41.8
90.0
138.2
150.0
156.4
160.5
90.0 last elevation angle in TIP
0. azimuth angle
0.998 minimum correlation coefficient for a valid tip
0.1 max allowable change in TIP iteration convergence (%)

LOS CONFIGURATION (Line 4 in data file)

1000 sky sampling time (milliseconds)
1000 blackbody sampling time (milliseconds)
1000 blackbody+noise diode sampling time (milliseconds)
1 number of sky samples per blackbody sample

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90.0 elevation angle
0.00 azimuth angle

RETRIEVAL COEFFICIENTS for January thru December (Line 5 in data file)

vap0	vap1	vap2	rmsvap	Tmr23
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
5.90301E-02	23.2935	-13.6836	2.68047E-02	287.262
liq0	liq1	liq2	rmsliq	Tmr31
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523
-1.50244E-02	-0.274174	0.794321	2.40308E-03	286.523

2.75 Cosmic Background Temperature (K)

WARMUP CONFIGURATION

5.0	Minimum difference between noise diode and blackbody (K)
0.50	Maximum dT/dt of mixer/noise diode temperature (K/min)
60	Maximum allowable warmup time (minutes)
100	Local Oscillator warm-up delay (milliseconds)
1.0	Moisture sensor ON/OFF threshold (volts)

PLOT CONFIGURATION

-180.	Minimum time to plot (minutes)
0.	Maximum time to plot (minutes)
30.	Time increment (minutes)
273.	Minimum temperature to plot (K)
333.	Maximum temperature to plot (K)
10.	Temperature increment (K)
2.	Minimum PWV to plot (cm)
7.	Maximum PWV to plot (cm)
1.	PWV increment (cm)
0.	Minimum airmass to plot
3.5	Maximum airmass to plot
0.5	Airmass increment
0.0	Minimum opacity to plot
1.0	Maximum opacity to plot

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0.2 Opacity increment

IRT CONFIGURATION (Line 6 in data file)

0000 IRT serial number (0000 = no IRT)
13 IRT attached to radiometer A/D channel no.
1.0 IRT voltage conversion slope (K/volt)
223.15 IRT voltage conversion offset (K)